

# Report from the NASA Astrobiology Institute

## July, 2004

### Research

- The second stage of a major NAI field effort, the Astrobiology Drilling Program (ADP) began last month in the Pilbara region of Western Australia. The first hole drilled, a joint project between the international Archean Biosphere Drilling Project (ABDP) and the U.S. Deep Time Drilling Project (DTDP,) successfully intersected the oldest erosion surface known on the Earth. Samples will provide previously unavailable data on biomarker molecules during the Archean, the ancient paleosol beneath the Warrawoona-Coonterunah unconformity, (possibly constraining the greenhouse-gas composition of the Earth's early atmosphere), and a complete biogeochemical inventory of the ocean-atmosphere system prior to the major global glacial and oxygenation events. This project leverages funds and resources of the Geological Survey of Western Australia, Kagoshima University, and the NAI Analytical activities are additionally supported by recent NSF award to a group of NAI and former NAI investigators at Arizona State University, Harvard, MIT, the University of Missouri, and the University of Washington.
- A Report was received and distributed this month from the NAI Virus Focus Group summarizing the results of their field expedition and workshop at Mono Lake and the Long Valley caldera region near Mammoth Lakes in eastern California (June 22-24). This unique environment provides a variety of habitats exhibiting extremes in temperature, pH, salinity and chemical composition. Individual investigators will examine the carbon metabolism, ecology, and community structure of the sites – and conduct metagenomic studies of the viruses, as well as bacteria and archaea. Since samples are being distributed among researchers, the results of specific analyses will be able to be integrated in ways not previously possible.
- **Recent Selected Accomplishments**
  - Evidence from the PennState NAI Team arguing for for a CO<sub>2</sub>-rich atmosphere before ~1.8 billion years ago. This work suggests that carbon dioxide alone, without a significant contribution from methane, could have provided the necessary greenhouse effect to maintain liquid oceans on the early Earth.  
Ohmoto, H., Watanabe, Y. & Kumazawa, K. (2004) Evidence from massive siderite beds for a CO<sub>2</sub>-rich atmosphere before ~ 1.8 billion years ago. *Nature* 429, 395 - 399
  - A synthetic chemical approach towards the *de novo* design of complex self-organized molecular systems has been developed and characterized by the Scripps NAI team. The dynamic features of the system may model the behavior of complex systems more generally.  
Ashkenasy G, Jagasia R, Yadav M, Ghadiri MR. (2004) Design of a directed molecular network. *Proceedings of the National Academy of Sciences* 101: 10872-10877 .
  - New magnetic data from Martian meteorite ALH84001 demonstrates that, although its contained magnetite is unusually pure and fine-grained, few, if any, of the crystals are arranged in chains. Alignment in chains has been proposed as one of the major properties of magnetites which are magnetosome in origin.  
Weiss BP, Kim SS, Kirschvink JL, Kopp RE, Sankaran M, Kobayashi A, Komeili A. (2004) Magnetic tests for magnetosome chains in Martian meteorite ALH84001. *Proceedings of the National Academy of Sciences* 101:8281-8284.

### NASA Missions

- An NAI-sponsored white paper, “Astrobiology Science Goals and Lunar Exploration”, was completed this month which defines and prioritizes the most significant astrobiological questions to be addressed by future missions to the Moon. The document, which captures the results of a workshop held in March, 2004, has been presented at NASA Headquarters and to the President's Commission on Moon, Mars and Beyond.

### **Strengthening the Astrobiology Community**

- Dates have been announced for 'NAI 2005: *The Biennial Meeting of the NASA Astrobiology Institute*'. NAI 2005 will be held April 11-14 with Sunday, April 10th, set aside for splinter groups, local field trips, and primer sessions. The meeting is being hosted by the University of Colorado NAI Team, in Boulder, Colorado.
- The NAI is proud to have co-sponsored the major international conference, *Bioastronomy 2004: Habitable Worlds*, which was held July 12-16 in Reykjavik, Iceland. The full spectrum of topics covered under bioastronomy were addressed, bringing together astronomers, biologists, and geologist, among others, to discuss the most recent discoveries in astrobiology - and to plan for future exploration missions.

### **Training**

- The NAI is pleased to have co-taught the Josep Comas i Sol Summer School in Astrobiology, July 5-9 at Universidad Internacional Menéndez Pelayo, Santander, Spain, together with the Spanish Centro de Astrobiología. This year's course was focused on presenting the planet Mars to astrobiologists. In addition to lectures by the leaders of the American and European Solar System exploration communities, the course was complemented by forward-looking discussions and workshops on orbiters and landers, especially those that are currently active or are being planned.
- Dr. David Morrison, Senior Scientist for the Astrobiology Institute, has been awarded the 2004 Carl Sagan Medal by the Division for Planetary Sciences of the American Astronomical Society. The Sagan Medal is awarded annually to an active researcher in the DPS for long-term excellence in the communication of planetary science to the public. The Sagan Medal will be presented to Morrison at DPS 2004, which will convene November 8-12 in Louisville, Kentucky.
- Sponsored Programs reviewed and selected two additional NAI graduate students as recipients of NAI Student Research Scholarships. Dominic Papineau, from the University of Colorado Center for Astrobiology, will receive support to conduct field sampling of Paleoproterozoic sediments in the Huronian Supergroup of Ontario, Canada. Alex Smirnov, of the Penn State Astrobiology Research Center, will receive a scholarship to collaborate with the University of Colorado NAI team on the stability of formates under conditions that might have been present on the early Earth.